



## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

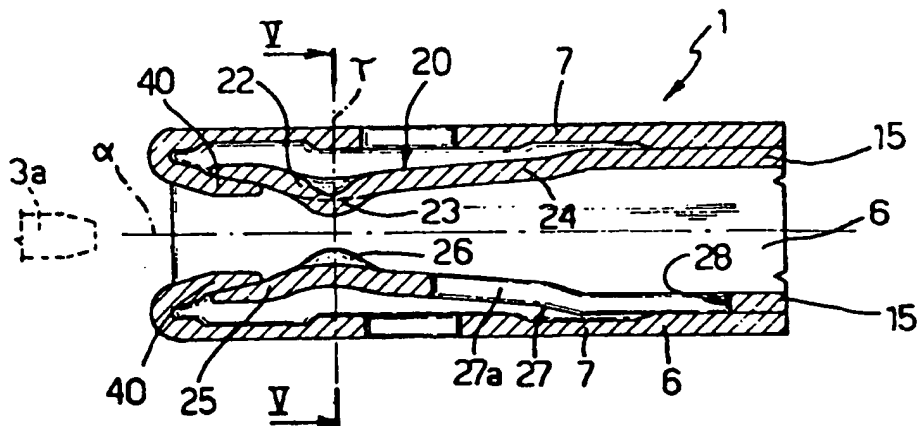
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<p>(21) International Application Number: <b>PCT/EP94/03413</b></p> <p>(22) International Filing Date: 17 October 1994 (17.10.94)</p> <p>(30) Priority Data: TO93A000765 18 October 1993 (18.10.93) IT</p> <p>(71) Applicant (for all designated States except US): <b>FRAM-ATOME CONNECTORS INTERNATIONAL S.A.</b> [FR/FR]; Tour Fiat, 1, place de la Coupole, F-92400 Courbevoie (FR).</p> <p>(72) Inventors; and (75) Inventors/Applicants (for US only): <b>GENTA, Alessandro</b> [IT/IT]; Via Pietro Cossa, 280/20, I-10151 Torino (IT). <b>RAMPONE, Renzo</b> [IT/IT]; Via Matilde Serao, 12, I-10124 Moncalieri (IT).</p> <p>(74) Agents: <b>BONGIOVANNI, Guido et al.</b>; Studio Torta, Via Vioti, 9, I-10121 Torino (IT).</p>	<p>(81) Designated States: BR, CA, JP, US, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).</p> <p><b>Published</b> <i>With international search report. Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i></p>	

(54) Title: FEMALE ELECTRIC TERMINAL

## (57) Abstract

A female electric terminal (1), particularly for automotive use, made of conductive sheet metal and integrally comprising a portion (4) for connection to an electric cable (5); and a box type contact body (2) having contact means (20, 21) cooperating with the opposite faces of a complementary male terminal (3a, 3b); the contact body comprising a bottom wall (6), a top wall (8), and a pair of sides (16) defined by an outer wall (7)

and an inner wall (15) turned on to the outer wall; the contact means consisting of a pair of flexible blades (20, 21) projecting from the inner walls (15) of the sides (16), asymmetrical in relation to the plane ( $\alpha$ ) of the male terminal (3a, 3b) so as to define offset contact areas on the respective faces of the male terminal, and comprising respective portions (24, 27) having at least approximately the same flexural rigidity.



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## FEMALE ELECTRIC TERMINAL

TECHNICAL FIELD

The present invention relates to an electric terminal, particularly for automotive use, and more specifically to a female electric terminal designed to mate with a male blade terminal.

BACKGROUND ART

Female electric terminals made by blanking and bending conductive sheet metal are known, and comprise, integrally, a deformable portion for connection to an electric cable; and a box body having a front opening for insertion of a male blade terminal, and contact blades cooperating with the male terminal.

U.S. Patent US-A- 4 834 681 relates to a female terminal of the above type, wherein the box body consists of a bottom wall, two sides connected integral with the bottom wall, and a top wall consisting of two portions, each connected to a respective side, and wherein the sides comprise an outer wall and an inner wall turned on to the outer wall. The contact blades consist of inner side wall portions projecting towards the front opening in the body, and cooperate with opposite faces of the male terminal.

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The contact blades of terminals of the type briefly described above are symmetrical in relation to the plane of the male terminal, so as to define facing contact areas on the opposite faces of the terminal.

5           Terminals of the aforementioned type however are only suitable for use with flat blade type male terminals, as opposed to those with shaped, e.g. ridged cross section, blades, which are becoming increasingly popular by virtue of requiring less material for given  
10           mechanical characteristics.

DISCLOSURE OF INVENTION

It is an object of the present invention to provide a female electric terminal of the aforementioned type, designed to overcome the aforementioned drawback typically associated with known terminals.

15           According to the present invention, there is provided a female electric terminal made of conductive sheet metal and integrally comprising a portion for connection to an electric cable; and a box type contact body defining an opening for insertion of a male blade  
20           type terminal, and having contact means cooperating with said male terminal; said body comprising a bottom wall, two sides connected integral with said bottom wall, and a top wall consisting of two portions, each connected to  
25           a respective said side; said sides comprising an outer wall and an inner wall turned on to said outer wall; said contact means comprising first and second flexible blade means projecting from said inner walls of said sides towards said opening and cooperating elastically

with respective opposite faces of said male terminal; characterized by the fact that said first and second blade means are asymmetrical in relation to the plane of said male terminal, so as to define offset contact areas on the respective faces of said male terminal; said first and second blade means comprising respective flexible portions having at least approximately the same flexural rigidity.

BRIEF DESCRIPTION OF DRAWINGS

A number of preferred, non-limiting embodiments of the present invention will be described by way of example with reference to the accompanying drawings, in which:

Figure 1 shows a view in perspective of a first embodiment of a female electric terminal in accordance with the present invention;

Figure 2 shows a blank from which to produce the Figure 1 terminal;

Figure 3 shows a side view of the Figure 1 terminal;

Figure 4 shows a partial longitudinal half section of the Figure 1 terminal;

Figure 5 shows a section along line V-V in Figure 4 of the terminal engaged by a flat blade male terminal;

Figure 6 shows the same section as in Figure 5 of the terminal engaged by a shaped blade male terminal;

Figure 7 shows a flat sheet metal blank from which to produce an electric terminal according to a second embodiment of the present invention;

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Figure 8 shows a cross section of a terminal formed from the Figure 7 blank;

Figure 9 shows a flat sheet metal blank from which to produce an electric terminal according to a third embodiment of the present invention;

Figure 10 shows a cross section of a terminal formed from the Figure 9 blank.

BEST MODE FOR CARRYING OUT THE INVENTION

Number 1 in Figure 1 indicates a female electric terminal, particularly for automotive use.

It should be stressed that terms such as "top", "bottom", "front", "rear" and similar in the following description are in no way limiting, and are used purely for reasons of clarity with reference to the position of terminal 1 as shown in Figure 1.

Terminal 1 is formed in one piece from conductive sheet metal by bending a flat blank 10 (Figure 2), the parts of which corresponding to those of terminal 1 described hereinafter are indicated in Figure 2 using the same numbering system.

Terminal 1 substantially comprises a contact body 2 designed to receive indifferently a flat blade male terminal 3a (Figure 5) or a terminal 3b with a shaped, ridged cross section blade and offset contact surfaces (Figure 6); and a deformable portion 4 for connection to an electric cable 5.

Body 2 presents a box structure, and comprises a bottom wall 6; a pair of outer lateral walls 7; and an outer top wall 8 defined by two side by side half walls

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9 integral with respective lateral walls 7. Each lateral wall 7 presents a window 7a designed to cooperate, in use, with snap-on connecting means formed in an outer insulating case (not shown) housing terminal 1.

5           At front portion 10 of body 2, half walls 9 mate laterally with each other so that portion 10 presents a closed rectangular section, and defines a front opening 12 for insertion of male terminal 3a or 3b. At rear portion 13 of body 2, half walls 9 form a mid  
10 longitudinal slot 11.

          At rear portion 13, body 2 presents respective inner top half walls 14 turned on to half walls 9 at the longitudinal edges of slot 11; and respective inner lateral walls 15 integral with inner half walls 14 and  
15 turned on to lateral walls 7 with which they define respective sides 16 of double thickness.

          From inner lateral walls 15, respective flexible blades 20, 21, arranged facing each other, project towards front opening 12, are designed to cooperate with  
20 opposite faces of the male terminal, and are curved with their convexities facing each other.

          According to the present invention, blades 20, 21 are asymmetrical in relation to the mid longitudinal plane  $\alpha$  (Figure 4) of terminal 1 defining the in-service  
25 plane of male terminal 3a or 3b, so as to define offset contact areas on the opposite faces of the male terminal.

          More specifically, and as shown by blank 10 in

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Figure 2, blade 20 is elongated and tapers slightly lengthwise towards an end portion 22 where it presents a contact 23 defined by a spherical-bowl-shaped impression.

5           Upon insertion of the male terminal, blade 20 is flexible substantially along a portion 24 extending between end portion 22 and respective inner lateral wall 15.

10           As shown by the corresponding portion 21 of blank 10 in Figure 2, blade 21 is elongated and tapers slightly towards an end portion 25.

15           Blade 21 is wider than blade 20, and presents, on end portion 25, two contacts 26 similar to and located on either side of contact 23, and symmetrical in relation to plane  $\beta$  perpendicular to plane  $\alpha$  and through the center of contact 23 (Figure 5).

          The centers of contacts 23, 26 lie in the same transverse plane  $\tau$  perpendicular to planes  $\alpha$  and  $\beta$ .

20           Upon insertion of terminal 3a or 3b, blade 21 is flexible substantially along a portion 27 extending between end portion 25 and respective inner lateral wall 15 and having a longitudinal slot 28 dividing it into two side by side longitudinal portions 27a, 27b.

25           According to the present invention, blades 20 and 21 are equally flexible upon insertion of terminal 3a or 3b, so as to transmit balanced elastic reactions to the respective faces of the terminal.

          For this purpose, flexible portions 24, 27 of



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blades 20, 21 present the same flexural rigidity, i.e. for a given thickness, the width of portions 27a, 27b is equal to half the width of portion 24 measured in the same transverse plane.

5           Blades 20, 21 are so formed as to assume, in the absence of external restraints, a more inclined position towards plane  $\alpha$  than that shown in Figure 2; and are preloaded, i.e. deformed outwards into the position shown, by respective tabs 40 originating from the front  
10           edge of lateral walls 7 and turned inwards of body 2 so as to enclose and cooperate with respective end portions 22, 25 of blades 20, 21, and so increase the contact pressure for a given deformation of the blades upon insertion of male terminal 3a or 3b. Tabs 40 also  
15           provide for protecting blades 20, 21 and preventing damage caused by misinsertion of the male terminal.

          From the rear edge of one of inner lateral walls 15, there extends a wall 29 turned 90° inwards of body 2 for closing it.

20           Figure 5 shows a cross section of terminal 1 engaged by a flat blade terminal 3a, and wherein contact 23 cooperates with a central portion of one face of terminal 3a, and contacts 26 with lateral portions of the opposite face.

25           Figure 6 shows a cross section of terminal 1 engaged by a terminal 3b with a shaped blade, in particular, having a ridged cross section with a central rib 30 and two lateral wings 31 offset in relation to

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rib 30. Though made of thinner material as compared with terminal 3a, terminal 3b presents the same mechanical characteristics by virtue of its ridged structure. In this case, contact 23 cooperates with rib 30, on the face projecting in relation to wings 31, while contacts 26 cooperate with the opposite face of respective wings 31. Since the distance between the planes of the contact faces of terminal 3b is typically equal to the thickness of terminal 3a, deformation of blades 20, 21 upon insertion of terminal 3a or 3b is identical in both cases and hence results in the same contact pressure. Consequently, electric and mechanical performance of terminal 1 is identical in both cases.

Figures 7 and 8 respectively show a blank 35, and a cross section of a female terminal 36 formed from blank 35 according to a further embodiment of the present invention.

Any parts of terminal 36 and blank 35 similar or equivalent to those of terminal 1 and blank 10 are indicated using the same numbering system.

Terminal 36 is identical to terminal 1 with the exception of blade 21.

As shown by portion 21 of blank 35 in Figure 7, blade 21 is substantially T-shaped, and comprises an end portion 25 substantially similar to the end portion of blade 21 of terminal 1; and a flexible portion 27 substantially similar to flexible portion 24 of blade 20.

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Figures 9 and 10 respectively show a blank 37, and a cross section of a female terminal 38 formed from blank 37 according to a further embodiment of the present invention.

5 Any parts of terminal 38 and blank 37 similar or equivalent to those of terminal 1 and blank 10 are indicated using the same numbering system.

Terminal 38 differs from terminal 1 by blade 21 being replaced by a pair of independent, side by side blades 21, as shown by portions 21 in Figure 9. Each blade 21 presents a respective contact 26, and comprises a flexible portion 27 of a width substantially equal to half the width of flexible portion 24 of blade 20 measured in the same transverse plane.

15 Terminals 36, 38 operate in the same way and present the same advantages as described with reference to terminal 1.

To those skilled in the art it will be clear that changes may be made to the terminals as described and illustrated herein without, however, departing from the scope of the present invention.

In particular, the blades need not necessarily present impressions defining the contacts.

25 In the case of blades with a flat cross section, the contact regions may be defined by simply curving the blades longitudinally, and contact with the flat surface of the male terminal is effected substantially along a generating line. The blades may also be curved

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transversely, in which case, contact is theoretically punctiform and in practice located in a circular area of tangency.

5       Finally, the female terminal according to the present invention permits the use of ridged-section male terminals turned over 180° in relation to that described, by appropriately adjusting the initial gap between the contact blades to achieve the required in-service contact pressure.

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## CLAIMS

1) A female electric terminal (1) made of conductive sheet metal and integrally comprising a portion (4) for connection to an electric cable (5); and  
5 a box type contact body (2) defining an opening (12) for insertion of a male blade type terminal (3a, 3b), and having contact means (20, 21) cooperating with said male terminal (3a, 3b); said body (2) comprising a bottom  
10 wall (6), two sides (16) connected integral with said bottom wall (6), and a top wall (8) consisting of two portions (9), each connected to a respective said side (16); said sides comprising an outer wall (7) and an inner wall (15) turned on to said outer wall (7); said  
15 contact means comprising first and second flexible blade means (20, 21) projecting from said inner walls of said sides towards said opening (12) and cooperating elastically with respective opposite faces of said male terminal (3a, 3b); characterized by the fact that said  
20 first and second blade means (20, 21) are asymmetrical in relation to the plane ( $\alpha$ ) of said male terminal (3a, 3b), so as to define offset contact areas on the respective faces of said male terminal (3a, 3b); said first and second blade means (20, 21) comprising  
25 respective flexible portions (24, 27) having at least approximately the same flexural rigidity.

2) A terminal as claimed in Claim 1, characterized by the fact that said first blade means (20) define a

first contact (23); and said second blade means (21) define two contacts (26) symmetrical in relation to a longitudinal plane (8) perpendicular to said plane ( $\alpha$ ) and through the center of said first contact (23), and  
5 the respective centers of which lie in a transverse plane ( $\tau$ ) through the center of said first contact (23).

3) A terminal as claimed in Claim 2, characterized by the fact that said first blade means (20) and said second blade means (21) comprise respective end portions  
10 (22, 25) defining respective said contacts (23, 26); said flexible portions (24, 27) integrally connecting said end portions (22, 25) to said inner-walls (15) of said sides (16).

4) A terminal as claimed in Claim 3, characterized  
15 by the fact that it comprises a pair of tabs (40) extending integrally from a front edge of said sides (16) and turned inwards of said body (2) so as to enclose respective said end portions (22, 25) of said blade means (20, 21).

20 5) A terminal as claimed in any one of the foregoing Claims from 2 to 4, characterized by the fact that said first blade means consist of a first blade (20) presenting said respective first contact (23); and said second blade means comprise a single second blade  
25 (21) presenting said respective two contacts (26).

6) A terminal as claimed in Claim 5, characterized by the fact that said flexible portion (27) of said second blade (21) presents an opening (28) dividing it

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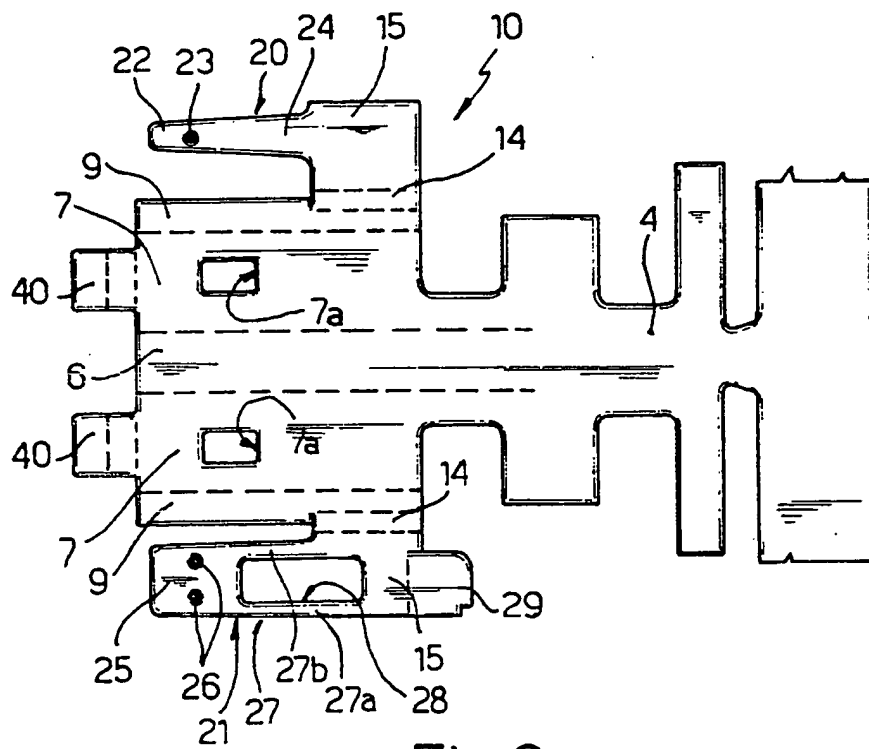
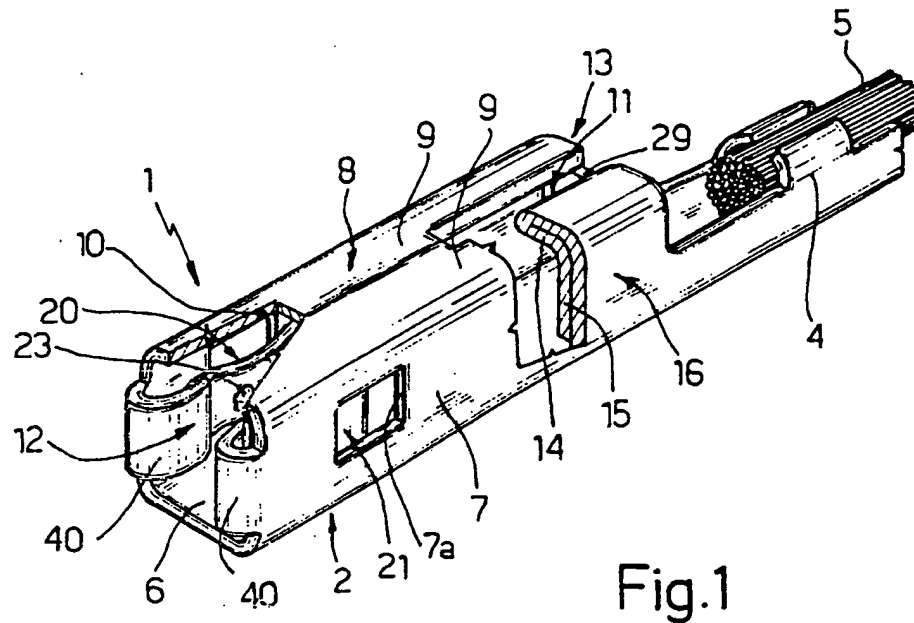
into two side by side, longitudinal portions (27a, 27b), each having a rigidity equal to half the rigidity of said flexible portion (24) of said first blade (20).

5 7) A terminal as claimed in Claim 5, characterized by the fact that said second blade (20) is substantially T-shaped; said flexible portions (24, 27) of said first blade (20) and said second blade (21) being similar to each other.

10 8) A terminal as claimed in any one of the foregoing Claims from 2 to 4, characterized by the fact that said first blade means consist of a first blade (20) defining said respective first contact (23); and said second blade means comprise two side by side blades (21) respectively defining said two contacts (26); said  
15 two blades (21) comprising respective flexible portions (27) the total flexural rigidity of which is substantially equal to the flexural rigidity of said flexible portion (24) of said first blade (20).

20 9) A female electric terminal, substantially as described and illustrated herein with reference to the accompanying drawings.

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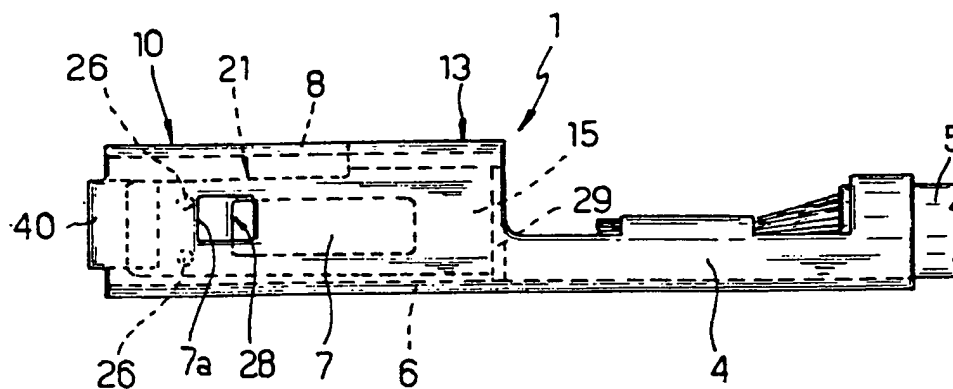


Fig. 3

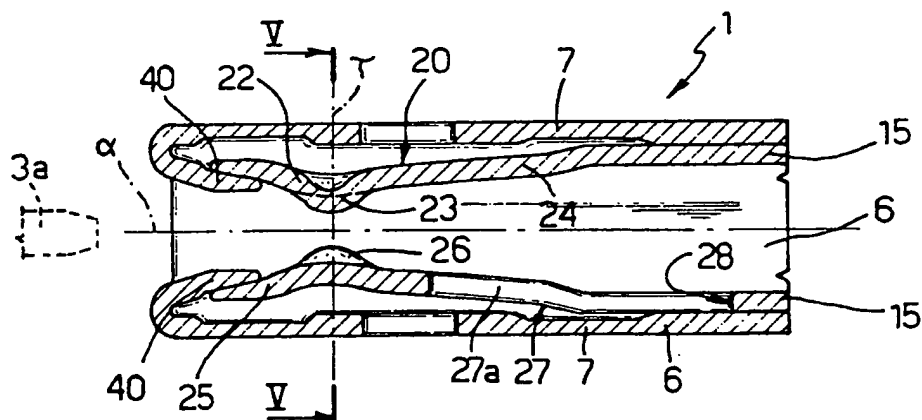


Fig. 4

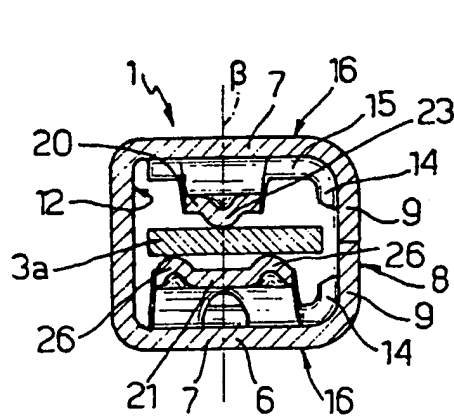


Fig. 5

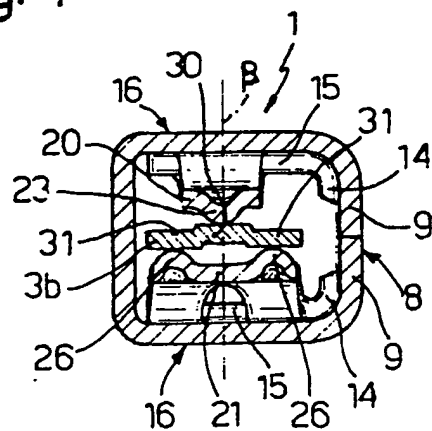
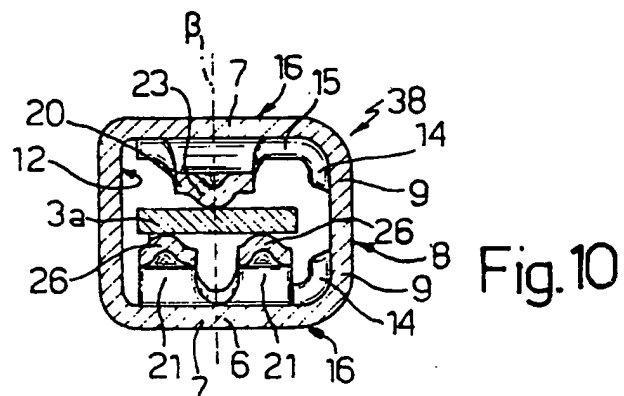
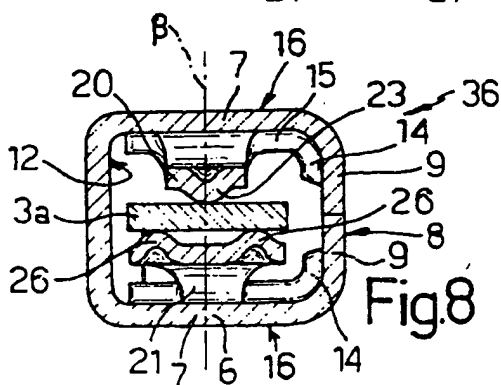
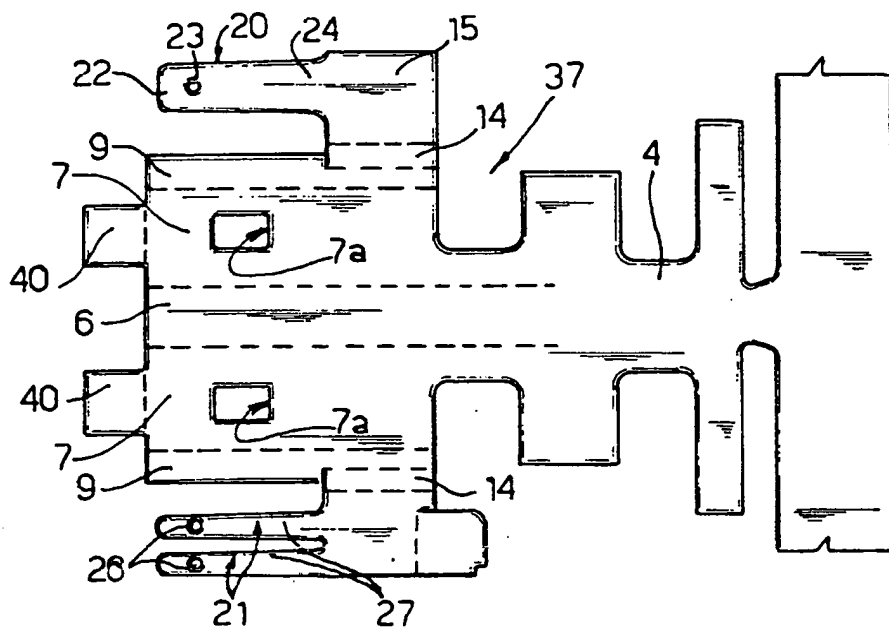
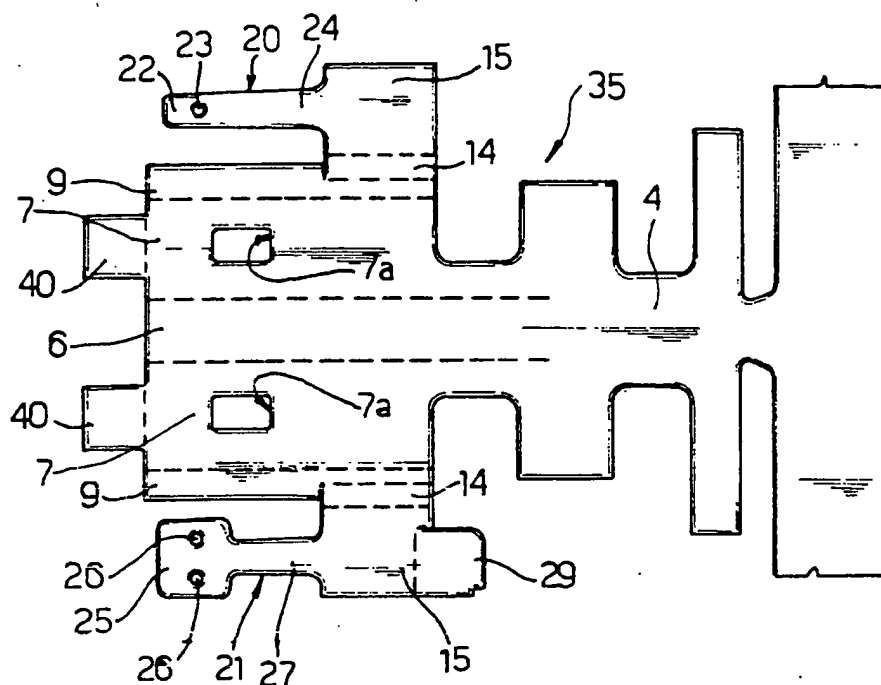


Fig. 6

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## INTERNATIONAL SEARCH REPORT

International application No.

PCT/EP 94/03413

## A. CLASSIFICATION OF SUBJECT MATTER

IPC6: H01R 13/115

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: H01R

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## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US, A, 4834681 (GEORGES CHAILLOT), 30 May 1989 (30.05.89), see whole document --	1-5,9
Y	US, A, 4717361 (YOSHIKI IGARASHI ET AL), 5 January 1988 (05.01.88), column 3, line 39 - column 4, line 6 --	1-5,9
Y	US, A, 4919628 (DEWEY F. MOBLEY ET AL), 24 April 1990 (24.04.90), column 4, line 18 - line 47 --	1-2,9

☒ Further documents are listed in the continuation of Box C.☒ See patent family annex.

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Date of the actual completion of the international search

31 January 1995

Date of mailing of the international search report

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## INTERNATIONAL SEARCH REPORT

International application No.

PCT/EP 94/03413

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US, A, 5106329 (TOSHIRO MAESHIMA ET AL), 21 April 1992 (21.04.92), column 2, line 23 - line 50  -----	1-5,9

SA 7899

**INTERNATIONAL SEARCH REPORT**  
Information on patent family members

31/12/94

International application No.  
PCT/EP 94/03413

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US-A- 4834681	30/05/89	DE-A- 3876739 EP-A,B- 0310487 FR-A,B- 2621180 JP-A- 5307983	28/01/93 05/04/89 31/03/89 19/11/93
US-A- 4717361	05/01/88	CA-A- 1296080 DE-A- 3685068 EP-A,B- 0214022	18/02/92 04/06/92 11/03/87
US-A- 4919628	24/04/90	EP-A- 0313253 JP-A- 1202328	26/04/89 15/08/89
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